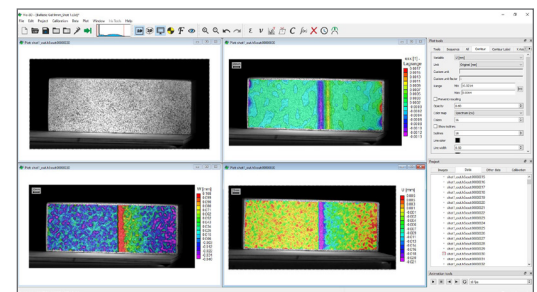


VIC-3D with *iris* High-Speed (HS)



The VIC-3D High-Speed (HS) digital image correlation system is a high-speed measurement system for full-field shape, displacements, velocities, strains, and much more. Standard systems with acquisition rates up to 500,000 frames per second and up to 4 megapixels are available, and ultra high-speed systems up to 5 MHz are also available. Systems are customized to the application and to meet budgets. Each system is streamlined and integrated with supported high-speed cameras with acquisition software VIC-Snap HS, which allows the user to acquire calibration and test images with ease. Synchronized images are seamlessly acquired and saved in the correct format for fast data analysis in VIC-3D. Furthermore, VIC-Snap HS enables external analog data to be recorded via an included data acquisition system, synchronizing load, or displacement data frame-by-frame.

The VIC-3D HS system includes all the benefits of the standard VIC-3D system in addition to fully-integrated high-speed cameras. Shape, dynamic motion, and strain are tracked and computed for every data point within the field-of-view. Since this data is calculated in three dimensions, out-of-plane displacements are measured directly, essentially eliminating bias. All calculations are completed quickly and seamlessly with the powerful VIC software suite.



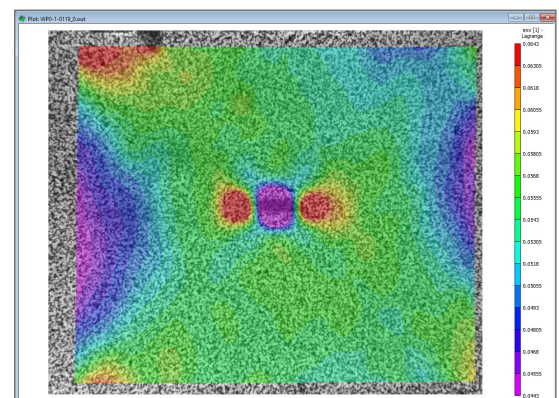
Shock wave caused by a bullet fired at ballistic gel.

Technology Overview

High-speed cameras are very useful for the qualitative assessment of high-speed events; however, it can be very tedious to obtain quantitative data from images without commercial image-processing software. Motion tracking software helps with this problem, but can only track movement at discrete points and is generally less accurate. Since the VIC-3D HS system analyzes a speckle pattern directly applied to the surface of the specimen, full-field data is captured and local strains are easily identified and measured. Common dynamic applications for this powerful system include (but are not limited to) crash testing, air bag deployment, vibration analysis, bird strike tests, ballistic events, explosive events, drop tests, Kolsky bar test, fracture mechanics, and much more.

Key Features

- **Full-Field Measurements** - Identify critical points and unrecognized hotspots by analyzing the entire area of a specimen rather than a single point.
- **Non-Contacting** - Eliminate all mechanical interaction with the sample for more accurate results.
- **User-Friendly** - Get the most accurate strain and deformation measurements quickly and easily with our turnkey, intuitive systems.
- **Advanced Data Visualization** - Create high-resolution, publication-ready plots in PDF and ultra-high-definition video (from 720p to 4K).



Bullet striking aluminum plate

CASE STUDY High-Speed Compression Test

Studying the behavior of metals during a high-speed dynamic compression event has always been challenging due to the complex test set up and fast data capture rates required. Utilizing high-speed cameras, the VIC-3D HS system can be used to quantify surface displacements and strains in three dimensions over an entire field with great precision. Digital image correlation (DIC) has gained widespread popularity in such high-speed applications due to its high accuracy, flexibility, and ease of use.

In this example, a 6 mm diameter cylindrical specimen was compressed at a strain rate of 50 s^{-1} . The VIC-3D HS system was used to capture the surface displacements and strains on the specimen during the event. A random speckle pattern was applied to the specimen that allows the analysis software to easily track the deformation to sub-pixel accuracy. Although the high-speed cameras are capable of much higher capture rates, for this test they were set to a frame rate of 14,400 fps to maximize spatial resolution while acquiring an adequate number of images during the event. The cameras were post-triggered at a resolution of 1024×400 pixels. After the event, the images were transferred to the computer's SSD, and then post-processed using the VIC-3D analysis software. Figure 2 shows a full-field contour plot of the transversal strain (Exx) overlaying the raw image at $t=4.4 \text{ ms}$. The compressive strain was found to be non-uniform.

"We have been using the Correlated Solution system for several years. The system is easy to set up and use, accurate and fast. Tech support is excellent since you can talk directly with the people that have developed the DIC technology."

**-Dr. Amos Gilat, Dynamic Mechanics of
Materials Lab, Ohio State University**

	VIC-3D High-Speed (HS)
Camera Resolution	Up to 4 MP
Frame Rate	Up to 500 KHz *
Exposure Time	Down to 159 ns **
In-Plane Resolution	$1/100,000 \cdot \text{FOV}$
Out-of-Plane Resolution	$1/50,000 \cdot \text{FOV}$
Strain Resolution	down to $10 \mu\epsilon$
Strain Range	from 0.005% to $> 2,000\%$
Analog Data Recording	8 inputs
FFT Module	Available

* Achievable at reduced resolutions; ** export license required

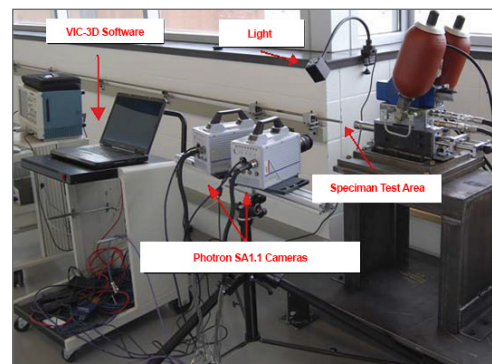


Figure 1
VIC-3D HS system setup

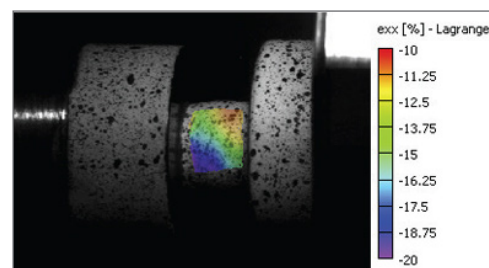


Figure 2
Full-field contour plot of the transversal strain (Exx)
overlaying the raw image at $t=4.4 \text{ ms}$



Figure 3
The VIC-3D HS system arranged vertically

Camera Disturbance Correction, Multi-System Stitching (requires multiple camera systems), Marker Tracking, and the all-new Iris data visualization engine are included in every system at no charge. VIC-3D data variables include 3D displacements, strains tensors, strain rates, velocities, accelerations, and much more. For each of these systems, the measurement area is mm^2 to m^2 , the strain measurement resolution is $10 \mu\epsilon$, and the strain measurement range is 0.005% to $>2000\%$.

Images courtesy of Amos Gilat & Jeremy Seidt at Ohio State University.